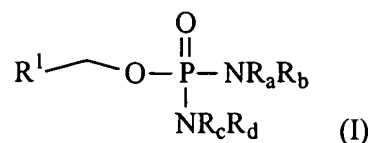


CLAIMS

What is claimed is:

1. A compound a compound of formula I:



wherein:

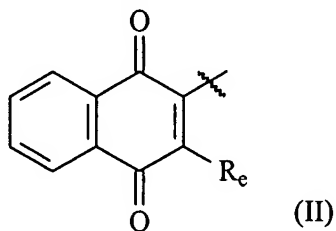
R^1 is an organic releasing group comprising a quinone ring;

R_a , R_b , R_c , and R_d are each independently hydrogen, (C₁-C₆)alkyl, or -CH₂CH₂X; and

each X is independently halo, (C₁-C₆)alkylsulfonyl, halo(C₁-C₆)alkylsulfonyl, or arylsulfonyl, wherein each aryl is optionally substituted with one or more (e.g. 1, 2, 3, or 4) halo, (C₁-C₆)alkyl, halo(C₁-C₆)alkyl, (C₁-C₆)alkoxy, (C₁-C₆)alkanoyl, (C₁-C₆)alkanoyloxy, (C₁-C₆)alkoxycarbonyl, cyano, nitro, or trifluoromethoxy;

provided at least two of R_a , R_b , R_c , and R_d are -CH₂CH₂X;
or a pharmaceutically acceptable salt thereof.

2. The compound of claim 1 wherein R^1 is a group of formula (II):

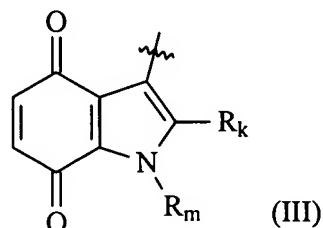


wherein R_e is hydrogen, halo, (C₁-C₆)alkyl, halo(C₁-C₆)alkyl, (C₁-C₆)alkoxy, (C₁-C₆)alkanoyloxy, cyano, nitro, or (C₁-C₆)alkylthio;

and wherein the benz ring is optionally substituted by one or more (e.g. 1, 2, 3, or 4) hydroxy, halo, (C₁-C₆)alkyl, halo(C₁-C₆)alkyl, (C₁-C₆)alkoxy, (C₁-C₆)alkylthio; (C₁-C₆)alkanoyl, (C₁-C₆)alkanoyloxy, (C₁-C₆)alkoxycarbonyl, cyano, nitro, mercapto, trifluoromethoxy, or NR_fR_g; wherein each R_f and R_g is independently hydrogen, (C₁-C₆)alkyl, (C₁-C₆)alkanoyl, phenyl, benzyl, or

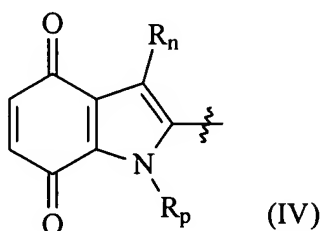
phenethyl; or R_f and R_g together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino.

3. The compound of claim 1 wherein R^1 is a group of formula (III):



wherein R_k is hydrogen or (C₁-C₆)alkyl; R_m is hydrogen or (C₁-C₆)alkyl, phenyl, benzyl, or phenethyl; and wherein the benz ring is optionally substituted by one or two hydroxy, halo, (C₁-C₆)alkyl, halo(C₁-C₆)alkyl, (C₁-C₆)alkoxy, (C₁-C₆)alkylthio; (C₁-C₆)alkanoyl, (C₁-C₆)alkanoyloxy, (C₁-C₆)alkoxycarbonyl, cyano, nitro, mercapto, trifluoromethoxy, or NR_fR_g ; wherein each R_f and R_g is independently hydrogen, (C₁-C₆)alkyl, (C₁-C₆)alkanoyl, phenyl, benzyl, or phenethyl; or R_f and R_g together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino.

4. The compound of claim 1 wherein R^1 is a group of formula (IV):



wherein R_n is hydrogen or (C₁-C₆)alkyl; R_p is hydrogen or (C₁-C₆)alkyl, phenyl, benzyl, or phenethyl; and wherein the benz ring is optionally substituted by one or two hydroxy, halo, (C₁-C₆)alkyl, halo(C₁-C₆)alkyl, (C₁-C₆)alkoxy, (C₁-C₆)alkylthio; (C₁-C₆)alkanoyl, (C₁-C₆)alkanoyloxy, (C₁-C₆)alkoxycarbonyl, cyano, nitro, mercapto, trifluoromethoxy, or NR_fR_g ; wherein each R_f and R_g is independently hydrogen, (C₁-C₆)alkyl, (C₁-C₆)alkanoyl, phenyl, benzyl, or

phenethyl; or R_f and R_g together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino.

5. The compound of claim 1 wherein X is bromo, chloro, mesyl, trifluoromethylsulfonyl, or tosyl.
6. The compound of claim 1 wherein X is bromo.
7. The compound of claim 2 wherein R_e is hydrogen, halo, methyl, or methylthio.
8. The compound of claim 3 wherein R_k is hydrogen or methyl.
9. The compound of claim 3 wherein R_m is hydrogen or methyl.
10. The compound of claim 4 wherein R_n is hydrogen or methyl.
11. The compound of claim 4 wherein R_p is hydrogen or methyl.
12. The compound of claim 1 wherein R_a is (C₁-C₆)alkyl.
13. The compound of claim 1 wherein R_c is (C₁-C₆)alkyl.
14. The compound of claim 1 wherein R_a and R_b are each independently -CH₂CH₂X.
15. The compound of claim 1 wherein R_c, and R_d are each independently -CH₂CH₂X.
16. The compound of claim 1 wherein R_b and R_d are each independently -CH₂CH₂X.

17. The compound of claim 1 wherein R_a is methyl.
18. The compound of claim 1 wherein R_c is methyl.
19. The compound of claim 1 wherein R_a and R_b are each $-\text{CH}_2\text{CH}_2\text{Br}$.
20. The compound of claim 1 wherein R_c , and R_d are each $-\text{CH}_2\text{CH}_2\text{Br}$.
21. The compound of claim 1 wherein R_b and R_d are each $-\text{CH}_2\text{CH}_2\text{Br}$.
22. The compound of claim 1 wherein R_a and R_b are each independently $-\text{CH}_2\text{CH}_2\text{Cl}$.
23. The compound of claim 1 wherein R_c , and R_d are each independently $-\text{CH}_2\text{CH}_2\text{Cl}$.
24. The compound of claim 1 wherein R_b and R_d are each independently $-\text{CH}_2\text{CH}_2\text{Cl}$.
25. The compound of claim 1 which is:
 - 2-(1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl) phosphorodiamidate;
 - 2-(3-Methyl-1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl) phosphorodiamidate;
 - 2-(3-Thiomethyl-1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl) phosphorodiamidate;
 - 2-(3-Bromo-1,4-naphthoquinonyl)methyl *N,N*-bis(2-chloroethyl) phosphorodiamidate;
 - 2-(1,4-Naphthoquinonyl)methyl *N,N*-bis(2-bromoethyl) phosphorodiamidate;
 - 2-(3-Methyl-1,4-naphthoquinonyl)methyl *N,N*-bis(2-bromoethyl) phosphorodiamidate;
 - 2-(1,4-Naphthoquinonyl)methyl bis[*N*-(2-chloroethyl)] phosphorodiamidate;

2-(1,4-Naphthoquinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;
 2-(3-Methyl-1,4-naphthoquinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;
 2-(1,4-Naphthoquinonyl)methyl bis[*N*-methyl-*N*-(2-chloroethyl)]phosphorodiamidate;
 3-(5-Methoxy-1-methyl-4,7-indolequinonyl)-methyl bis[*N*-methyl-*N*-(2-bromoethyl)] phosphorodiamidate;
 3-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;
 2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;
 2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-chloroethyl)-phosphorodiamidate; or
 2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;
 or a pharmaceutically acceptable salt thereof.

26. The compound of claim 1 which is:
 3-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;
 2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl bis[*N*-methyl-*N*-(2-bromoethyl)]phosphorodiamidate;
 2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-chloroethyl)-phosphorodiamidate; or
 2-(5-Methoxy-1-methyl-4,7-indolequinonyl)methyl *N,N*-bis(2-bromoethyl)-phosphorodiamidate;
 or a pharmaceutically acceptable salt thereof.

27. A pharmaceutical composition comprising a compound of claim 1, in combination with a pharmaceutically acceptable diluent or carrier.

28. A therapeutic method for preventing or treating cancer comprising administering to a mammal in need of such therapy, an effective amount of a compound of claim 1.
29. The method of claim 28 wherein the cancer is a solid tumor.
30. The method of claim 28 wherein the cancer is a solid tumor.
31. A method for preparing a compound of formula I as described in claim I, wherein R¹ is a group of formula II, III, or IV, comprising oxidizing a corresponding compound of formula I wherein R¹ is a group of formula VI, VII, or VIII.